DEVICE AND METHOD FOR FILLING LIQUID OR PASTY PRODUCTS HAVING LUMPY FRACTIONS AND FREE FLOWING, POURABLE LUMPY PRODUCTS

The invention relates to a device and a method for filling liquid or pasty products having lumpy fractions and free flowing, pourable lumpy products comprising a storage container, means for opening or closing the outlet of the storage container and a gravity tube arranged underneath the storage container, wherein the gravity tube has at least one flexible side wall and that means for mechanically pressing-in the at least one side wall of the gravity tube are provided.

Devices for filling lumpy portions together with liquid or pasty or free flowing or pourable products are available on the market in various designs and have been known for some time. Said devices are used to fill the product from a storage container having a closable outlet through a so-called gravity tube either directly into a packaging container located directly thereunder and to be closed subsequently or into a metering tube so that the packaging containers can be filled uniformly either on a volumetric or on a gravimetric basis.

A bunker for powder or granular material is known from DE-AS 10 97 904 which describes a device and a method for emptying pourable and free flowing products wherein a flexible gravity tube at the lower end of the container can be moved towards one another or moved away from one another by means of suitable elements so that the flexible gravity tube can be completely closed.

A similar device is known from DE 32 06 003 A1 where the lower region of a transport or storage container is flexibly configured, by providing belts there. These belts are tightened more or less by means of suitably articulated rollers to change the cross-section of the throughput.

In both the aforesaid known devices however, it is only possible for two parallel sides of the gravity tube to move.

When a "gravity tube" is merely mentioned in the following, this should include any design of hollow transport pipes. In particular, the invention should thus also relate to gravity hoses consisting entirely of a flexible material.

Whereas the filling of liquid products generally involves no problems, during the filling of pasty products, especially if these have lumpy fractions, blockages occur again and again in the area of the gravity tube since the product sticks or wedges in the area of the gravity tube, that is the position having the smallest cross-section during the filling process. This "bridge formation" results in problems during the filling: the result is inadequately filled packages (rejects), machine down-time and therefore increased maintenance expenditure.

The object of the invention is thus to configure and further develop the device and the corresponding method for filling specified initially and described previously in detail so that any product blockage in the gravity tube is reliably eliminated. It is further desired that the filling accuracy

is increased. Damage to the lumpy fractions of the product should also be reliably excluded.

The object is solved in a generic device by the fact that the means for mechanically pressing in the side wall of the gravity tube have rotatable elements for deforming the cross-section of the gravity tube and that the elements are driven rotatably about an axis of rotation running substantially parallel to the gravity tube.

In terms of method the object is solved by the fact that the means for mechanically pressing in the side wall of the gravity tube intermittently deforms the flexible side wall of the gravity tube inwards according to a specified scheme.

The invention has recognised that the disadvantages of the known filling devices described further above can be reliably avoided by using a gravity tube having a flexible side wall in conjunction with means for mechanically deforming this side wall. In this case, the cross-sectional shape of the gravity tube initially plays no role. A further teaching of the invention provides that the gravity tube has a polygonal cross-section, for example, a square cross-section, that each flexible side wall is constructed as deformable and that separate elements for mechanical pressing-in are provided for each side wall. In this way, all the side walls of the gravity tube are pressed in mechanically, optionally according to a special sequence scheme to be explained further below, so as to reliably exclude any bridge formation of the product in the interior of the gravity tube or gravity hose.

A further teaching of the invention provides that the gravity tube has a substantially round cross-section and that the elements for mechanically pressing in the side wall of the gravity tube are arranged distributed uniformly around the circumference of the gravity tube. In a further embodiment of the invention, in such round-cross-section gravity tubes the elements for mechanically pressing in the side wall of the gravity tube can be arranged rotatably about the axis of the gravity tube. This design offers design advantages compared with a plurality of pressing-in elements arranged around the gravity tube.

In a further development of the invention, the elements for mechanically pressing in the side wall of the gravity tube can be arranged displaceably in the axial direction. The various movements on the flexible side wall of the gravity tube can also be superimposed to achieve particularly favourable effects.

According to a further preferred teaching of the invention, the rotatable elements for mechanically pressing in the side wall of the gravity tube are constructed as rollers or as cams for deforming the cross-section of the gravity tube. In this case, it is especially appropriate if the rollers or cams are rotatably driven and the axis of rotation runs substantially parallel to the gravity tube. By attaching a plurality of "camshafts" arranged parallel to the gravity tube around the gravity tube, each having a plurality of cams arranged rotatably above one another, numerous deformation patterns can be achieved.

As has already been mentioned, the solution of the invention in terms of method provides that the intermittent deformation of the gravity tube takes place according to a specified scheme. In this case, the deformation of the side wall of the gravity tube can take place simultaneously or staggered in time, in which case the means for mechanically pressing in the side wall of the gravity tube can act uniformly on the side wall of the gravity tube over the entire circumference. In the design solution using rollers described further above, for example, it is possible to arrange a plurality of rollers, each arranged one above the other, around the gravity tube wherein the individual rollers in the various planes act above one another on the gravity tube such that any deformation of the gravity tube takes place in the sense of peristaltic motion.

The invention is explained in detail subsequently with reference to drawings which merely show preferred exemplary embodiments. In the figures:

Fig. 1 is a schematic side view of a first exemplary embodiment of the device according to the invention,

Fig. 2 shows a plan view of the device according to the invention from Fig. 1 and

Fig. 3 shows a vertical section of the device according to the invention according to Figs. 1 and 2.

Figure 1 shows a schematic side view of a gravity tube 1 which has at least one flexible side wall 2. In addition to the

gravity tube 1 having a product P comprising lumpy fractions, a plurality of rollers 4 arranged rotatably about an axis of rotation 3 running parallel to the gravity tube 1 are also provided. As can be seen from Fig. 2, in the exemplary embodiment shown and insofar preferred, four rollers 4 are arranged about a drive shaft 5 wherein supports 6 arranged in a cross provide for mounting of the rotatable rollers 4 and their spacing from the drive shaft 5. For clarity only four rollers arranged in one plane are shown in Fig. 1. A plurality of individual supports 6 with rollers 4 arranged rotatably thereon are arranged one above the other, as can be seen from Fig. 3, so that the gravity tube 1 can now be deformed as far as possible over its entire height. In this case, the drive shaft 5 is mounted in two bearings 7a and 7b, which are connected to a housing, not shown, by means of supporting arms 8a and 8b. In the exemplary embodiment the drive shaft is driven by means of a cogged belt 9 which is merely indicated.

It can quickly be seen that if the rollers 4 of the individual planes of the device shown in Fig. 3 are arranged radially offset, various deformations of the side wall 2 of the gravity tube 1 can be achieved. For example, the rollers 4 arranged at the top first come in contact with the side wall of the gravity tube not shown in Fig. 3 and then those arranged thereunder in each case. This results in a type of milling movement in the direction of transport and is especially gentle for the product to be transported.

Instead of the rollers 4, it is also feasible to use cams, although this is not shown, which bring about the desired

deformation of the flexible gravity tube 1 from outside simultaneously or staggered in time or place.

It is clear that a plurality of the arrangements according to the invention can be arranged around the gravity tube 1. In the exemplary embodiment shown and insofar preferred, the gravity tube 1 has a rectangular cross-section so that corresponding rollers 4 can act on all four side surfaces 2. Here also, a "deformation scheme" of the gravity tube 1 matched to the special product can be achieved by the matched sequence of impact of the individual rollers 4 relative to the different planes and the different side walls 2.